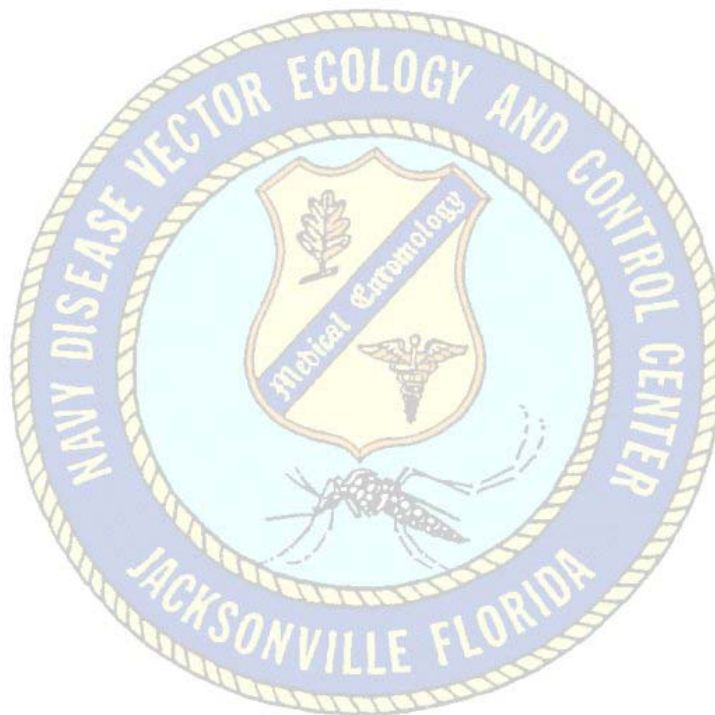


**Navy Disease Vector Ecology and Control Center  
Jacksonville, FL**



---

**WEST NILE VIRUS  
SURVEILLANCE GUIDE  
2002**

References: (a) OPNAV 6250.4b

(b) DoD 4150.7

The goal of this document is to explain the importance of West Nile virus (WNV) surveillance, to recommend and explain steps involved in a thorough surveillance and control program for this virus, to offer action thresholds based on WNV presence in birds, mosquitoes and people, and to recommend action responses based on risk levels. While the potential health threat for military personnel developing illness from WNV is low, isolated cases cannot be excluded.

1. Background. West Nile encephalitis is caused by West Nile virus and has caused the death of several people in the United States. Most deaths have occurred in people with suppressed immune systems (usually elderly people). Since its first detection in New York City during summer 1999, WNV has continued to spread across the United States. Although WNV has mainly been found in American crows and blue jays and has been spread predominantly by *Culex* spp. mosquitoes, WNV has been detected in more than 80 species of birds, 22 mosquito species, and a variety of mammals. While WNV has been recovered from some birds and mosquitoes from several CONUS US Navy installations, there have been no human cases onboard any Department of the Navy installation.

Most people exposed to WNV either show no symptoms or develop a mild, flu-like illness including fever, muscle aches, swollen glands and skin rash. A small percentage of people infected with WNV become more severely ill developing meningitis or encephalitis with symptoms that may include headache, high fever, fatigue, dizziness, stupor, neck stiffness, confusion, coma, and very infrequently, death. Persons over 50 years old or those with immune suppressed health are more likely to become severely symptomatic when infected. Consistent with European outbreaks, human mortality due to WNV infection is rare in people under 50 years old.

WNV is transmitted to humans through the bite of an infected mosquito, often- but not exclusively- from *Culex* species. Mosquitoes become infected when they feed on WNV infected birds. Infected mosquitoes can then transmit WNV when they feed on humans or other animals. WNV is not transmitted from person to person and there is no evidence that handling live or dead infected birds can infect a person. It is often the case that bird-feeding mosquitoes spread the disease from bird to bird until bird populations reach such a high WNV level that general-feeding mosquitoes spread WNV to humans. In this way, WNV is harbored in birds, transferred and amplified among bird populations by mosquitoes, and then transmitted to humans. WNV can be maintained at high levels in bird populations through mosquitoes that seem unimportant to us because they don't feed (or rarely feed) on mammals. By controlling larvae and adult population numbers of avian-feeding mosquitoes as well as those that typically feed on humans, the harboring of WNV should be more limited in birds, and cases of WNV 'bridging' into humans should become less frequent.

## 2. Purpose of this Guide.

a. The Navy Disease Vector Ecology and Control Center, Jacksonville, Florida (DVECC-JAX), provides guidance for disease vector surveillance and control programs for Navy and Marine Corps installations in the Eastern United States. We provide this document as general guidance for all Navy and Marine Corps installations from the Atlantic coast west to the Mississippi River. This guide will greatly assist installations in their WNV surveillance and prevention efforts. Because each base is

unique, this guide is meant to be general for each installation. However, it is highly recommended that any modifications be made in close consultation with DVECC-JAX.

b. It is recommended that Navy and Marine Corps installations in the Eastern and Central United States assess WNV risk on their installation, conduct continual WNV surveillance appropriate to their region throughout the local mosquito breeding season, and take appropriate preventive and responsive action to reduce WNV risk to their active duty and dependent populations. Per OPNAV 6250.4b, the medical facility on each installation is ultimately responsible to that installation's Commanding Officer for the health of personnel on that installation and to inform the CO of risks on that installation.

c. Additional mosquito surveillance assistance or WNV training or technical assistance can be obtained by contacting DVECC-JAX or Navy entomologists at Navy Environmental and Preventive Medicine Unit Number Two (NEPMU-2), Norfolk, VA. Dead birds should be collected and processed through installation veterinarians. In 2002, cost-free WNV testing using mosquitoes collected by the installations is being provided by the US Army Center for Health Promotion and Preventive Medicine - North (USACHPPM-North). Contact information can be found in Appendix A.

3. WNV Surveillance and Protection Plan. Preventive medicine personnel responsible for the health of personnel affiliated with United States Navy and Marine Corps installations may choose from three general options when implementing WNV surveillance and control efforts, or any combination that completely meets that installation's WNV plan. Any plan should include dead bird surveillance; mosquito breeding site surveillance and reduction; larval mosquito surveillance and control; adult mosquito surveillance, testing for and control of WNV; data collection and reporting; and program assessment. Regardless of how a WNV program is implemented, each installation should liaise with their local mosquito abatement/public health government agency to notify them of their WNV plan and to establish communication with them.

General Surveillance Options:

**a. Local Mosquito Control Agencies.** If local, county or state agencies are currently performing surveillance, testing and control measures that meet or exceed US Navy WNV recommendations, then arrangements may be able to be made with that agency to include the military installation as part of the local agency's operations. Data should still be reported to DVECC-JAX.

**b. Private Contractor.** The installation may develop and implement a contract with civilian mosquito controllers that meets or exceeds US Navy WNV recommendations. Data should still be reported to DVECC-JAX.

**c. DoD Personnel.** Installations may use DoD medical personnel and equipment to implement the WNV Plan. Data should be reported per US Navy WNV Guide.

4. US Navy West Nile Virus Plan Recommendations.

**a. Larval Mosquito Development Site Reduction.** Site reduction is a fundamental control measure for reducing, or even eliminating mosquito populations. Because mosquitoes have specific requirements for successful reproduction (water, a blood meal, and a place to rest and lay eggs) these are the most efficient areas to concentrate control efforts. By finding and eliminating or treating potential larval sites, one can limit mosquito problems and WNV threat before a health problem is noticed. Tire piles should be removed, containers of any kind outdoors should be discarded, standing water should be drained and depressions that hold water should be filled when possible. Surveillance should be done in bodies of water that cannot be removed to determine if mosquito larvae are present.

Larval surveillance should begin well before adult mosquitoes are present in a region and continue through the fall (mosquito larvae are active once water temperatures reach 15°C).

**b. Larval Control.** Larval mosquito surveillance and control are also essential components of any effective and efficient WNV program. Mosquito breeding site identification should begin during early/mid Spring by surveying the installation in person and marking actual and potential sites on a base map. Breeding sites may or may not have larvae at the time of survey. Larval surveillance should continue throughout the mosquito-breeding season because the species composition of the mosquito populations may change within a single breeding site. Surveillance should include collection (done with a simple plastic or enamel dipper on the end of a 3-4 foot pole), identification of larva, mapping and monitoring of larval sites within installation, and looking for new sites as weather or other conditions change. Appropriate control measures include removal/draining of natural or artificial temporary or permanent wet areas and removal of water containers (coffee cups, cans, bottles, bird baths, rain gutters, pool covers, and tire piles). Potential larvacides include (but are not limited to) *Bacillus thuringiensis* briquettes (NSN 6840-01-377-7049), insect growth regulators (IGR) such as Methoprene briquettes (NSN 6840-01-424-2495) or liquid (NSN 6840-01-424-2493). While mosquito larvae can be identified, many personnel prefer to identify the adults. Immatures can be reared to adults in larval rearing chambers (using rearing chambers can also determine if the IGR is effective). Preventive Medicine workers may need to provide the Department of Public Works a detailed work request to eliminate mosquito-breeding sites.

**c. Adult Surveillance and Control.**

- 1) **Trapping Methods.** Adult surveillance can be conducted using CO<sup>2</sup>-baited light traps such as the Solid State Army Miniature (SSAM) Hock Model 1012 (NSN 3740-01-106-0091), the CDC model 512 which can be purchased from <http://home.acceleration.net/jwhock/>, and baited gravid traps (CDC Gravid Trap, Unit Price - \$88.00, available through commercial entomological supply sources such as <http://home.acceleration.net/jwhock/>). Mosquitoes collected in old style traps (i.e. New Jersey Light Traps) often do not leave mosquitoes viable for WNV testing, however, mosquitoes usually do remain alive and viable for WNV testing if collected in gravid traps, SSAM or CDC light traps. The number of traps used will depend on the size of installation, but minimum trapping efforts for any installation should include 2 nights per week with at least 2 of the above-mentioned traps. Ideally, an average sized installation should use about 6 traps located at critical areas. Larger installations, those with housing, those with a greater variety of habitats, or those located in areas of active WNV transmission may need to have a greater trapping effort. Trapping effort should be great enough to trap mosquito representatives from all areas of concern (e.g. housing, bodies of water, horse stables, public use areas, wet areas).
- 2) **Lures.** The SSAM or CDC light traps should be used with 4-5lbs of CO<sup>2</sup> (dry ice) per night and can be used without the light source (to avoid non-mosquitoes). About 1 quart of luring material should be used in gravid traps. Standing water from the surrounding area can be used with decaying vegetation to form a luring mixture, or a luring mixture could be made by aging for 2 days a combination of approximately 1 cup of rabbit pellet food and 1 gallon of natural-source water (do not use tap water, instead water found in the area should be used as it has microbes needed to make the rabbit food attractive for oviposition).
- 3) **Adult Control.** Adult mosquito control is often done by ground ULV spraying (such as Sumetherin (NSN 6840-01-474-7751), Pyrethrins (NSN 6840-01-104-0780) or Resmethrin (NSN 6840-01-359-8533) etc) and can be an acceptable and immediate way to reduce

mosquito populations; however, adulticide applications, sometimes conducted on three to four consecutive days timed to coincide with daily peak activity periods of the target species may be required to noticeably reduce mosquito populations. For control of larger areas or when severe outbreaks occur, aerial spray operations may be considered. DVECC-JAX should be contacted if this latter option is being considered. It is important to note that **no mosquito control plan should rely solely on spraying adulticides in response to mosquito complaints**. Surveillance, breeding site reduction and larval control measures should continue until the first killing frost occurs.

**d. Dead Bird Surveillance.** Bird morbidity/mortality has been found to be a very sensitive early WNV detection system. Any dead bird found on an installation must be reported to installation veterinary staff who should be prepared to properly recover, assess, and prepare the bird for WNV testing by either a federal or state lab. Current research indicates that the surveillance factor most closely associated with the number of human cases is *dead crow density* (number of dead crows per square mile), and most of the WNV positive birds reported have been dead American crows. However, many bird species have been found to harbor WNV, and reporting dead birds should not be limited to crows. In fact, collection data from 1999-2001 show that WNV confirmation in an area could be delayed weeks if only dead crows were reported.

**e. Public Education and Cooperation.** Information dissemination to the public, support communities (public health departments, health care providers, veterinary communities, etc.) and other governmental entities is critical for the effective implementation of a WNV plan. News bulletins and interviews, literature, web sites, newspaper articles should be considered to inform local military and other DoD personnel the risks and precautions associated with WNV. Tab Q of the USACHPPM WNV plan contains examples of several public notices:

<http://chppm-www.apgea.army.mil/ento/westnile/South/Cover.pdf>.

**f. Mosquito Identification.** Identification of larval mosquitoes can be difficult. However, larvae can be reared to adults in larval rearing chambers (NSN 3740-01-454-2345) and identified in their adult form. For each trap, sort the newly emerged adult mosquitoes from other collected insects, then sort male and female mosquitoes. Mosquito identification is only required to genus level. DVECC-JAX and EPMU-2 can provide more detailed assistance for training personnel in mosquito identification if desired.

**g. Processing Mosquito Specimens.** USACHPPM-North prefers a cold-chain be kept for mosquitoes to be tested. As soon as possible after collecting the mosquito adults for WNV testing, they should be immobilized by freezing them. They should be kept frozen until and during identification (a chill table should be used while handling specimens; see Appendix B) and a cold-chain should be maintained at all times in order to keep mosquitoes viable for testing. Ice packs should be used when shipping specimens for WNV testing.

**h. Submitting Specimens for WNV Testing, Documentation and Reporting.**

- 1) USACHPPM-North is currently supporting WNV testing within the entire DoD. Adult mosquitoes should be pooled and shipped to USACHPPM-North weekly for WNV testing. Mosquito pooling is done by putting up to 25 females (from the same trap and night) of the same genus into a tube provided by USACHPPM and affixing a label per instructions in Appendix C. Samples should be kept frozen until they are sent overnight to USACHPPM-North packed in the USACHPPM-supplied shipping container with ice packs. Specimen information (Mosquito Pooling Information form found in Appendix D) should accompany the specimens.

- 2) USACHPPM-North will compile and forward results electronically back to the installation, to DVECC-JAX, the state public health department that will forward the data to the CDC, and to the Department of Defense Global Emerging Infections System (DoD-GEIS). The USACHPPM-North points of contact for WNV testing can be reached at 301-677-3466 or 301-677-3962.
- 3) Ensure all phases of mosquito surveillance are documented in a logbook used only for mosquito surveillance in a manner similar to Appendix E.
- 4) If the installation is not conducting WNV surveillance or testing directly (if it is being performed through a local agency or contractor) or if WNV mosquito testing is not conducted through USACHPPM-North, the installation should still report that data electronically to DVECC-JAX weekly in a fashion similar to Appendix F.
- 5) A log of any vertebrates that are tested for WNV should be maintained in a fashion similar to the Vertebrate WNV Testing Data Sheet (Appendix G) that should be reported to the installation Pest Management Coordinator and to DVECC-JAX monthly.
- 6) Suspected human WNV cases should be reported directly to the Navy Environmental Health Center (NEHC) CDO at (757) 621-1967. Suspected human WNV cases must be diagnostically confirmed by testing serum or cerebrospinal fluid (or other appropriate tissue) and results reported to DVECC-JAX and NEHC.

**i. WNV Risk Levels and Response.** WNV Risk Levels have been established to serve as a proposed guide for prevention and action measures in response to increasing risk levels. WNV Levels are described in Appendix H. along with actions that should be taken.

## Appendix A.

### **Contact Information**

#### **Navy and Marine Corps WNV Surveillance Program Issues/Questions:**

**Navy Environmental Health Center, Portsmouth, VA (NEHC):**

757-953-0717, (DSN 377)

**Navy Disease Vector Ecology and Control Center, Jacksonville, FL (DVECC JAX):**

Officer in Charge (OIC), 904-542-2424 (DSN 942) [cmd@dveccjax.med.navy.mil](mailto:cmd@dveccjax.med.navy.mil)

#### **Navy Entomologists:**

**DVECC JAX:**

Operations Department (904) 542-2424 DSN 942-2424

**Navy Environmental and Preventive Medicine Unit Number Two, Norfolk, VA (NEPMU-2):** (757) 444-7671 or DSN 564-7671

#### **Mosquito WNV Testing at USACHPPM-North:**

(301) 677-3932, ext. 3466 or ext. 3806  
ARMY CTR FOR HEALTH PROMOTION  
& PREVENTIVE MEDICINE (ATTN: WNV Testing)  
ENTOMOLOGICAL SCIENCES DIVISION  
BUILDING 4411, LLEWELLYN AVE.  
FORT GEORGE G MEADE MD 20755-5225

#### **Human WNV sample testing:**

Contact NEPMU TWO, Norfolk (757) 444-7671 ext 3022 or DSN 564-7671

#### **Other WNV Program Links:**

CDC WNV Surveillance Program:

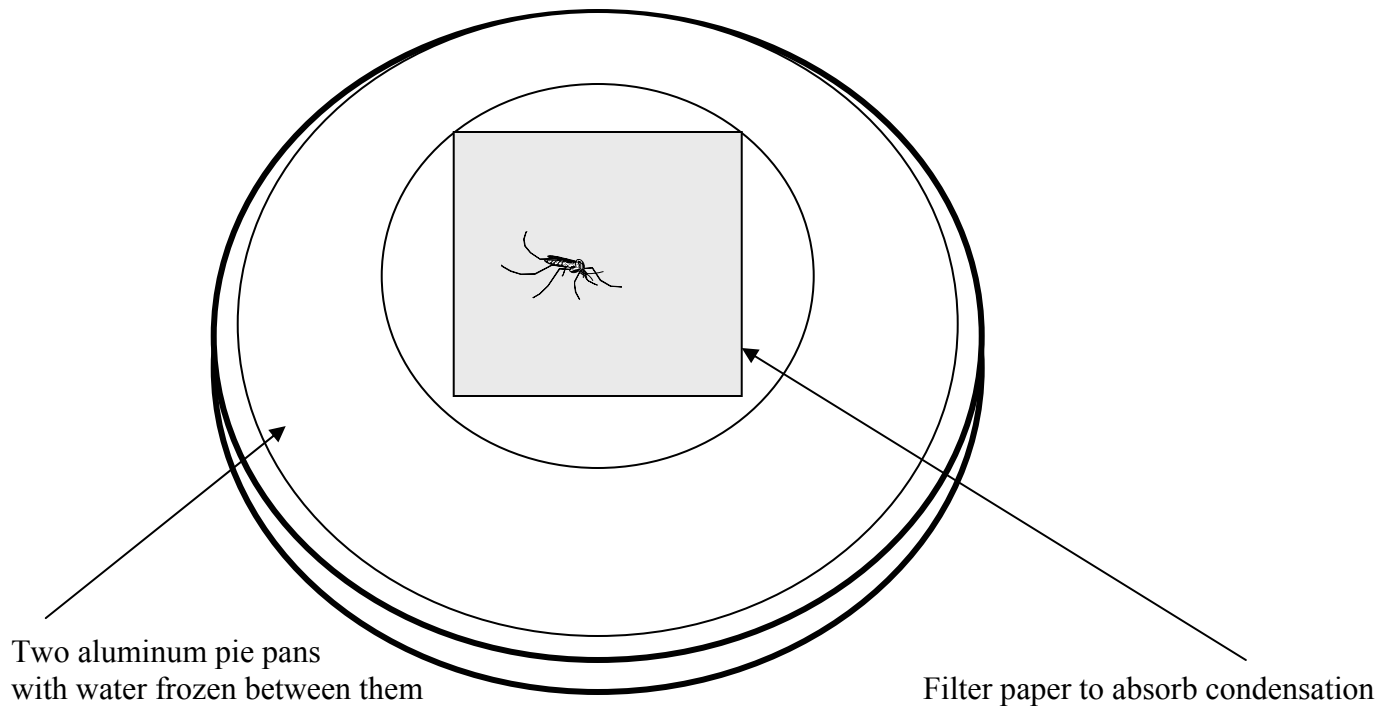
<http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-apr-2001.pdf>

USACHPPM WNV Mosquito Surveillance Program:

<http://chppm-www.apgea.army.mil/ento/westnile/South/Cover.pdf>

Appendix B.

**Cold plate used to keep specimens frozen while sorting and identifying.**





Appendix C.

**West Nile Virus Mosquito Surveillance  
Pooling Instructions and Data Recording  
For Testing at CHPPM-North (5-18-01)**

1. Refer to data form entitled "[Mosquito Pool Information, West Nile Virus Surveillance](#)" (Appendix E) and read "codes and explanations" at bottom of sheet
2. After killing trap catches by freezing (at least 20 minutes at -20), empty the net contents on a chill table (or pan with frozen substrate) and sort and discard non-mosquitoes and male mosquitoes (although note the number of males).
3. Identify and count female mosquitoes while keeping them on the chill surface. Pool up to 25 female mosquitoes, of the same genus, from the same trap, in a tube.
4. Place the pre-printed log number label (provided by USACHPPMM-North) on the side of the sample tube. Write, with an indelible pen, the corresponding log number (e.g. 001) on the cap. You do not need to rewrite the installation identifier.
5. Write the log number (e.g., 001, 002, etc.) in the "Pool Log #" column of the data sheet.
6. **IMPORTANT:** Do not mix different installations on the same data sheet. Do not duplicate log numbers. Always pick up with the next number that follows the one that ended the last trapping period. You can keep track of this by photocopying and retaining data sheets at the end of each collection period. It is OK to indicate "0" trap catches in the "number of mosquitoes" section, but **DO NOT ASSIGN A POOL LOG #** to it. Put a dash or XXXX in the "Pool Log #" column.
7. After samples are pooled and data recorded, place vials in the freezer and arrange for overnight delivery.
8. Pack samples, sandwiched between at least 5 frozen freezer packs (e.g., blue ice), in a cooler or insulated box. Be sure a copy of the data sheet is included with the samples. Overnight ship (e.g., FEDEX) the box to:

**ARMY CTR FOR HEALTH PROMOTION  
& PREVENTIVE MEDICINE (ATTN: WNV Testing)  
ENTOMOLOGICAL SCIENCES DIVISION  
BUILDING 4411, LLEWELLYN AVE.  
FORT GEORGE G MEADE MD 20755-5225**

Further Tips: It is OK to use solid continuation lines for information that is redundant within a column.  
It is OK to draw a squiggly line through a row to divide different trap nights  
Only pool FEMALE mosquitoes. DO NOT USE DUPLICATE POOL NUMBERS.

Appendix E.

**Example of logbook entry for mosquito surveillance documentation**

<u>Date</u>	<u>Collection Time</u>	<u>Method</u>	<u>Location</u>	<u>Larval/Pupal/Adult</u>	<u>#♀ / Genus</u>	<u>Collector</u>
25-26 Apr '01	1800-0600	CDC Lt & CO <sup>2</sup>	behind hospital	A	17 <i>Culex</i>	HM <sup>3</sup> von Linne
25-26 Apr '01	1800-0600	CDC Lt & CO <sup>2</sup>	behind hospital	A	4 <i>Aedes</i>	HM <sup>3</sup> von Linne
25-26 Apr '01	1800-0600	CDC gravid	walking trail pond	A	23 <i>Culex</i>	HM <sup>3</sup> von Linne
25-26 Apr '01	1800-0600	CDC gravid	horse stable pond	A	16 <i>Anopheles</i>	HM <sup>3</sup> von Linne
28-29 Apr '01	1800-0600	CDC Lt & CO <sup>2</sup>	behind hospital	A	20 <i>Culex</i>	HM <sup>2</sup> Darwin
28-29 Apr '01	1800-0600	CDC Lt & CO <sup>2</sup>	behind hospital	A	8 <i>Aedes</i>	HM <sup>2</sup> Darwin
28-29 Apr '01	1800-0600	CDC gravid	walking trail pond	A	23 <i>Culex</i>	HM <sup>2</sup> Darwin
28-29 Apr '01	1800-0600	CDC gravid	horse stable pond	A	17 <i>Anopheles</i>	HM <sup>3</sup> von Linne

## Appendix F.

## Weekly Mosquito Testing Report

COLLECTION WEEK:

[illegible]

An example data sheet for reporting WNV mosquito testing results to DVECC JAX if WNV surveillance and testing is not done by DoD personnel.

## Appendix G.

## Vertebrate WNV Testing Data Sheet

COLLECTION

WEEK:

[illegible]

An example report form for reporting vertebrate WNV testing results to the installation Pest Management Coordinator, and DVECC JAX.

Appendix H. WNV Risk Levels

WNV Transmission

Potential	Condition		Action
<b>none</b>	<b>Level 1A</b>	Off season, mosquitoes inactive, climate unsuitable	Determine if new WNV Plan measures have been issued, liaise with local agencies
	<b>Level 1B</b>	Early Spring, adult mosquitoes not active	Begin larval breeding site mapping, surveillance, and source reduction
	<b>Level 1C</b>	Adult mosquitoes active but not problematic (no complaints),	Begin adult surveillance
<b>low</b>	<b>Level 2A</b>	Surveillance finds adult mosquitoes active, but no complaints	Public education and personal protection information should be provided
	<b>Level 2B</b>	Complaints of mosquito biting or mosquito traps collecting numbers of mosquitoes but no WNV found on installation	Consider adult &/or larval control measures, increase mosquito and dead bird surveillance, use ground truth maps for controlling breeding sites
	<b>Level 2C</b>	dead bird(s) found where cause of death is unknown	Have installation vets or local public health agency test for WNV, increase surveillance for dead birds, public announcement about what public should do if a dead bird is found
<b>med</b>	<b>Level 3</b>	WNV confirmed in dead bird(s) locally or 1 or more WNV+ mosquitoes in traps	Consult with local mosquito abatement agencies & DVECC-JAX, get public involved with environmental sanitation, consider increased adulticides and/or change in adulticide(s)
<b>high</b>	<b>Level 4</b>	1 or more WNV+ person or 1 or more WNV+ horse in area	Greater public announcement, consider wider use of adulticides esp. in public use areas, consult with local mosquito abatement agencies, consult with DVECC-JAX

**Note:** Once an activity is started, it should be continued until the end of season or risk decreases.